Atmospheric Modeling of Air Pollutants with the Community Multi-Scale Air Quality (CMAQ) Model

Ken Schere
Branch Chief, Atmospheric Model Development Branch
ORD/NERL/AMD
(919) 541-3795
schere.kenneth@epa.gov

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Computer simulation of atmospheric processes related to criteria pollutants and air toxics is essential for an effective air quality management system. The Community Multi-Scale Air Quality (CMAQ) modeling system is the latest example of the state-of-the-science product of NERL's Atmospheric Modeling Division. This numerical model simulates the concentrations of multiple pollutants on continental, regional, and local scales for extended time periods. The model treats the effects of meteorology, atmospheric transport, chemical transformation in the atmosphere, pollutant exchange with the surface, and variability in pollutant emissions in predicting pollutant concentrations. Work is underway to refine modeling capabilities at the urban and neighborhood scales to address exposure assessment issues. Application and evaluation of the CMAQ model for a full-year (2001) nationwide simulation is continuing. In addition to the use of the CMAQ model as an assessment tool, it is also emerging as a forecast tool. NOAA's National Weather Service and NERL's Atmospheric Modeling Division have recently initiated a program to develop and test numerical models to provide real-time forecasts of pollutant concentrations over the continental United States. The pilot program uses a forecast version of EPA's CMAQ modeling system to forecast the next-day ozone concentrations across the northeastern United States. The scope of this program will be expanded to include the continental United States, the forecasting of fine particulate matter concentrations and visibility, and the extension of the forecast period to three days in the future. The resulting database will also be used to examine the temporal and spatial variability of pollutants and their effects on human health. Combined with daily health advisories to the public, this program will increase the effectiveness of the air quality management and assessment activities across the country. The CMAQ model is also being used to study the linkage between air quality and climate change. This involves the assessment of intercontinental transport of pollutants, the examination of the effects of global climate change on air quality, and the effects of regional air quality on climate change. The model is also utilized to understand the multimedia aspects of environmental and ecological stresses that are essential to managing complex multimedia environmental systems. Research tasks being addressed include nitrogen/nutrient deposition, acid deposition, and cross-media interactions of mercury and other toxic pollutants.